

BACKGROUND REPORT
ON
DELTA WATER ISSUES

Prepared by
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INTRODUCTION

The Delta Protection Commission is charged with preparation of a land use and resource management plan for the primary management area of the Delta, as defined in the Delta Protection Act (see Figure 1). The Plan is to be adopted by the Commission and forwarded to the five Delta Counties for adoption and implementation through the existing regulatory process.

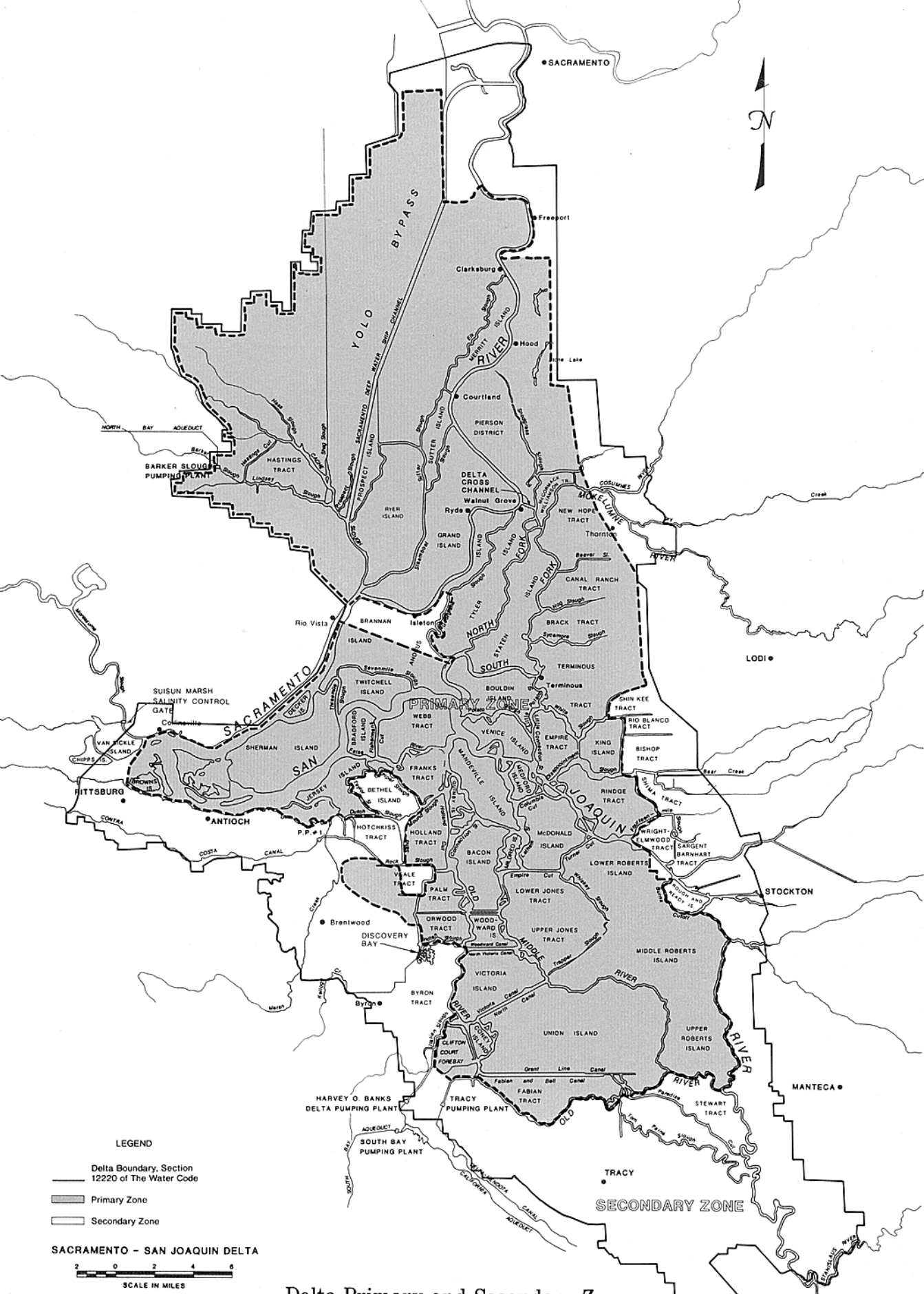
The Delta Protection Act requires the regional plan to "preserve and protect the water quality of the Delta, both for in stream purposes and for human use and consumption." The Act further directs that the "Water Code shall prevail" if there are conflicts or inconsistencies, and the Act further states that "nothing in this division authorizes the Commission to exercise any jurisdiction over matters within the jurisdiction of... any other State agency."

Regulation of water quality and water use in the State is under jurisdiction of several State and federal agencies-Regional Water Quality Control Boards, State Water Resources Control Board, Department of Water Resources, Bureau of Reclamation, Environmental Protection Agency, and many others; the Delta Protection Commission and local governments do not have authority or responsibility to regulate use of water or water quality.

The Delta Protection Commission and local governments can affect the type and location of land uses which do affect water use and water quality. The report focuses on issues associated with agriculture, the primary land use in the Delta. The report touches on several issues associated with water usage in the Delta which affect agriculture.

Thousands of pages have been written about the State's water, the water distribution system, water quality, and water use. This report presents only a very brief, general introduction to these issues for the Commission.

Due to the very limited budget and very short timeline allotted the Delta Protection Commission to complete the task of preparing the Plan, this report is based on existing references, albeit the latest and most up to date. The report relies heavily on materials prepared by the Department of Water Resources and the Central Valley Regional Water Quality Control Board. Maps are also from the Department of Water Resource's Delta Atlas, published in 1993.



Chapter I: THE STATE'S PHYSICAL WATER SYSTEM (1)

Chapter I outlines the State's natural water system and describes the systems which redistribute water within the State. The Chapter emphasizes the Delta's role as heart of both the State's natural drainage system and the constructed water systems. The Chapter also touches on the issue of groundwater and the current pattern of overdraft.

1. Sources of Water.

Most water (96%) enters the State in the form of precipitation--rain in the lower elevations and snow in the higher mountains. The amount of precipitation within the State varies from region to region. In the Delta, the average precipitation is about 28 inches a year; the highest precipitation is in the northwest areas of the State with over 100 inches a year; the area of lowest precipitation is southern California desert areas with about 2 inches a year, and the statewide average is 23 inches a year. California is a "Mediterranean" climate, which means the precipitation falls largely in the winter, with little or no precipitation in the summer. Other parts of the United States receive ample rainfall in the summer, which naturally irrigates crops. California must hold and redistribute its annual precipitation in order to have water for irrigation, industrial, municipal, and personal use in the long summer and fall months with no precipitation and high demand.

2. Distribution of Water.

In the period from the 1920's to the 1970's, the State and federal water projects, individual water and irrigation districts, and utilities built hundreds of dams on the rivers in the State to capture runoff from winter rains and spring runoff from melting snow. These dams also provide flood control, cheap electric power, and water-oriented recreation. The Cosumnes River is the only major undammed river in the Delta watershed. Rivers now protected as Wild and Scenic Rivers include: Smith, Klamath, Trinity, Van Duzen, Scott, Eel, Salmon, Feather, Tuolumne, and American Rivers. Of these, only the Smith River is undammed.

The Delta is the heart of the natural drainage system and is the central point of much of the water redistribution systems (see Figure 2). About 75% of the State's water originates north of Sacramento; and about 75% of the State's water needs occur south of this point. Historically, the Delta has received about 40% of California's total runoff via the Sacramento and San Joaquin Rivers. The watershed of the Delta is shown in Figure 2. The Sacramento River provides 85% of flow into the Delta, the San Joaquin River about 10%, and other eastside streams about 5% (see Figure 3). Surface waters provide about 60% of water for consumptive purposes; about 40% is pumped from groundwater supplies.

For the entire State, of an average year's 76 million acre feet of surface water runoff, 32% flows into rivers and the ocean; 31% is used for agriculture; 29% is protected under the wild and scenic rivers system or used for Delta fresh water and fish flow requirements; 6% is used for personal consumption and industrial use; and 2% flows into Nevada.

3. Central Valley Project.

The federal Central Valley Project (CVP) was started during the Depression, following a long drought that began in 1928. The first portion of the project provided water to Contra Costa County in 1940. In 1951, the Tracy Pumping Plant began operation. The CVP project stores and transports water from the Sacramento and San Joaquin Rivers for use primarily in the Central Valley for irrigation. The project currently delivers about eight million acre feet a year through 20 dams and reservoirs, eight power plants, and about 500 miles of canals and aqueducts. The facilities were built by the U.S. Bureau of Reclamation (Bureau) and the U.S. Army Corps of Engineers and are managed by the Bureau. The project includes Shasta, Folsom, and Millerton Lakes, the Tracy Pumping Plant, and the Delta Mendota Canal.

4. State Water Project.

The State Water Project (SWP) was authorized by the Legislature in 1951, the plan was released to the public in 1958, and the first bonds--\$1.75 billion--were approved in 1960. The system began operation in 1962. Major reservoir facilities upstream from the Delta are: Lake Oroville (3.5 million cubic feet) and San Luis Reservoir (2.04 million cubic feet) which is co-owned with the Bureau of Reclamation. The overall project includes 18 reservoirs, 17 pumping plants, 8 hydroelectric plants, and 550 miles of aqueducts and reservoirs. The extensive pumping needed to move the water through the system make the State Water Project the largest single user of electricity in the State, about 10 billion kilowatt-hours a year. The water is taken from the southern Delta at the Delta Pumping Plant at the Clifton Court Forebay. The water is distributed through the California Aqueduct.

The project is not completed, but currently provides 2.4 million acre feet of water per year, out of the 4.2 million to be delivered if and when the project is completed. Southern California and San Joaquin Valley are the two largest users of the project waters; 40% of the project water is used for agriculture, the remainder is for domestic and industrial uses.

5. The Delta.

For both of these projects, the Delta acts as a key part of the water transportation system. Water from the watershed is held upstream in the many dams. At the time of the year when the water is needed, it is released into the existing river channels and flows into the Delta. The huge pumps in the two pumping plants transfer water from the south Delta into the aqueducts. The Delta Cross Channel near Locke, which moves water from the Sacramento River into the North Fork of the Mokelumne River, was constructed to move water within the Delta. The State has acknowledged that the water transportation system impacts Delta levees and Delta fisheries.

In 1986, the officials of the two projects signed a Coordinated Operation Agreement to allow equitable sharing of available surplus water and to provide for sharing responsibilities in meeting present Delta water quality standards.

6. Other Water Projects.

Delta Flows Components and Comparisons

The major components of the Delta Water Supply are illustrated below along with the components which use this supply. These figures contain average annual values for the recent period of 1980 – 1991. The average annual inflow to the Delta is 27.840 thousand acre-feet (TAF) for this period with the Sacramento and San Joaquin rivers contributing over 75 percent. Average annual Delta water use also totals 27.840 TAF with outflow to

San Francisco Bay being the major component. When Delta outflow is compared to the average tidal flow at the Golden Gate or Chipps Island, its magnitude diminishes greatly. The figure to the left illustrates this point. It compares average Delta outflows for winter and summer with average tidal flows at the Golden Gate and Chipps Island.

Average annual
inflows to
the Delta:
27,840 TAF

Yolo Bypass
3,970

Delta Precipitation
990

Sacramento River
17,220

East Side Streams
1,360

San Joaquin River
4,300

Average annual
outflows
& diversions:
27,840 TAF

Contra Costa P.P.
110

Banks P.P.
2,490

Delta Outflow to Bay
21,020

Consumptive Use &
Channel Depletion
1,690

Tracy P.P.
2,530

All values in thousand acre-feet (TAF).

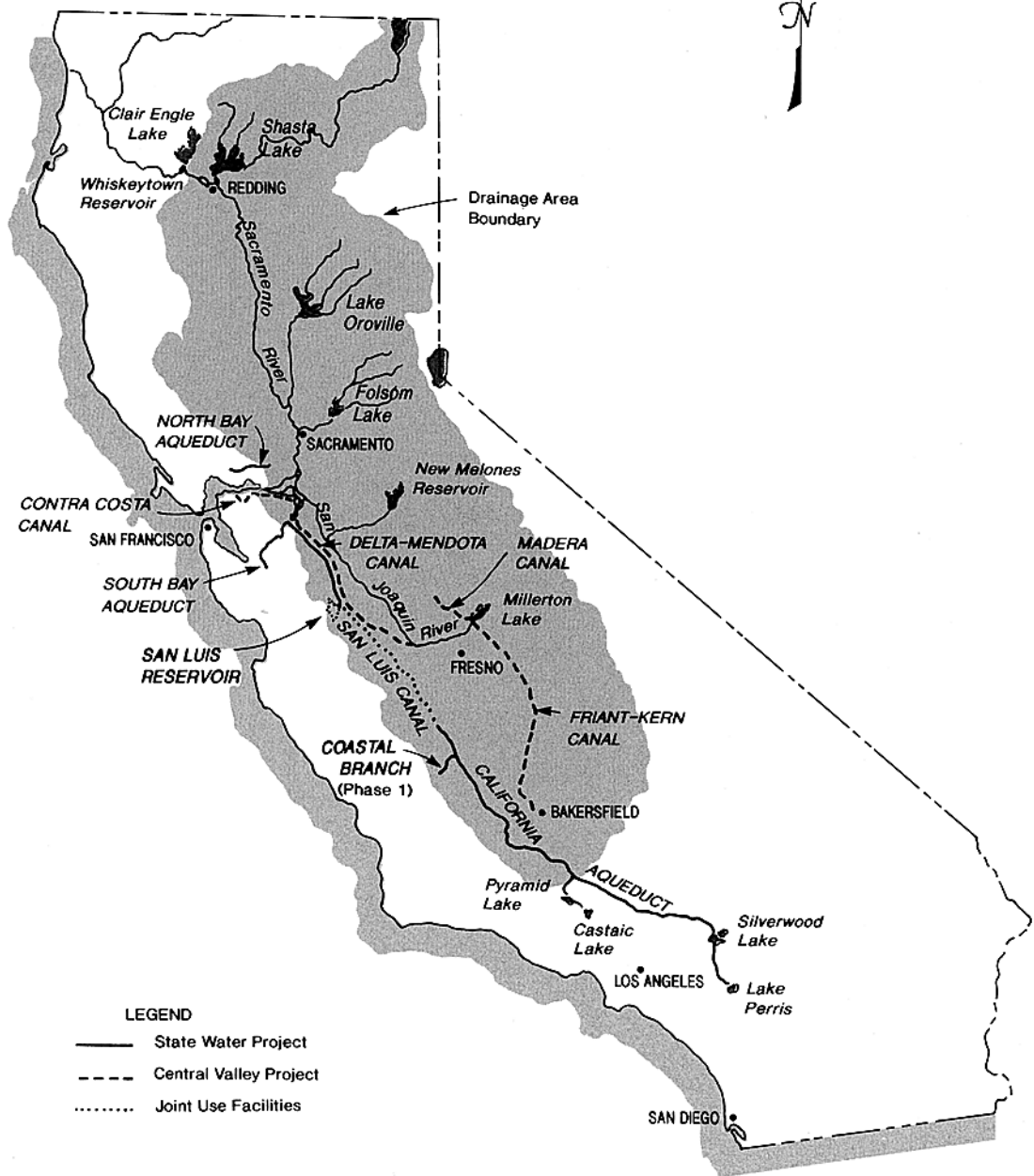
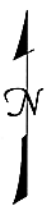
The Bay Area receives water from the Hetch Hetchy Reservoir on the Tuolumne River, which is piped directly to the Crystal Springs Reservoir, bypassing the Delta. Pardee Reservoir, built by East Bay Municipal Utility District, provides water piped through the Delta to the East Bay via the Mokelumne Aqueducts, Los Angeles transports water from east of the Sierras via the Los Angeles Aqueduct, and receives water from the Colorado River via the Colorado River Aqueduct. The Colorado River also supplies water to Imperial Valley agricultural lands.

7. Groundwater.

Statewide, groundwater is stored in 400 groundwater basins holding 43 million acre feet of water. On the average, 16.6 million acre feet of groundwater is pumped yearly, meeting about 40% of California's water needs. Less than half the groundwater is close enough to the surface to be economically pumped to the surface. Natural recharge comes from rainfall, snowmelt, and stream seepage with an average return of 5.8 million acre feet of water annually. Another 7.4 million acre feet seeps back into groundwater basins after being used for agricultural, municipal, and industrial purposes. In addition 1.1 million acre feet of imported surface water and 300,000 acre feet of seepage water from unlined irrigation canals is intentionally recharged to the groundwater basins each year. However, statewide, groundwater pumping exceeds recharge by 2 million acre feet a year--an "overdraft".

Overdraft can raise the cost of pumping water, cause land subsidence, diminish future aquifer capacity, cause seawater intrusion, and result in movement of poor quality water into other parts of a basin or an adjoining basin. The greatest incidence of overdraft is the San Joaquin Valley where the annual overdraft has been reduced from 1.7 million acre feet per year in the 1950's and 1960's to the current 1.3 million acre feet per year from groundwater basins holding 500 million acre feet of water. Many water districts are actively involved in groundwater recharge; more than 65 water agencies operate recharge projects.

Groundwater pumping is not uniformly regulated. Special areas have had water issues resolved in court, and the Legislature has formed groundwater management districts in several counties.



Major Features of State Water Project
and Central Valley Project

Chapter II: WATER USAGE

Most of the water in the State's developed water systems, about 83%, is used for agriculture and about 17% is used for "urban" uses. Urban uses include residential, office, business, industrial and public uses such as landscaping and parks. New federal rules direct the developed water system managers to release some water for "environmental" purposes (2). As the population of the State increases, the need for "urban" water will continue to increase, although conservation and new construction techniques are slowing the rate of increase. An average household uses one-half to one acre foot of water per year. Per capita water varies region to region with hot inland cities, such as Sacramento, Fresno, and Bakersfield, using 300 gallons per day per capita (one acre foot per year for a three person household), and coastal cities, such as San Francisco and San Jose, using less than 200 gallons per day per capita (two-thirds of one acre foot of water per year for a three person household). More than two-thirds of the people of California receive at least part of their drinking water from the State Water Project. Residents of the Delta do not use the State's developed water systems. Agricultural irrigation water is taken directly from sloughs and rivers; drinking water comes from wells or community water systems.

1. Agricultural Water Use.

a. General Agricultural Water Use. The amount of agricultural water use is determined by the extent of irrigated acreage, the relative proportions of crop types grown, weather, and irrigation efficiency. The total acreage of irrigated farmland in the State has increased from 4 million acres in 1930 to the current level of about 9 million acres. The mix of crops has changed over time and continues to change based on fluctuating market conditions, costs of production, and federal crop control programs. Department of Water Resources (DWR) predicts the need for irrigation water will stay relatively stable in the future at about 27 million acre feet per year. No increase in irrigated agricultural lands is predicted; some lands may be removed from irrigation.

Agricultural use of water includes transpiration by plants, and evaporation from soil, and leaching (water necessary to keep salt concentration in root zone at levels that will not adversely affect plant growth; water in the root zone typically has salt concentration 3 to 8 times that of water used for irrigation).

Rates of evapotranspiration vary from crop to crop (the rates listed below will also vary from place to place). The following table (3) shows the rate of evapotranspiration for different crops:

Small Grains**	1.4 ft/yr	Pinto Beans	1.7"/yr
Grain and Sorghum**	1.8 "/yr	Corn**	2.2"/yr
Cotton	2.7"/yr	Sugar Beets**	2.8"/yr
Rice	3.3"/yr	Deciduous Orchards**	3.5"/yr
Alfalfa**	4.1"/yr	Pasture**	4.1"/yr

** Indicates crops grown in the Delta.

The following table (4) illustrates the total amount of water used statewide to irrigate different crops for one year. Statewide, about one-third of evapotranspiration is through alfalfa and irrigated pasture, accounting for about 25% of the net water used in the State (for 1985, in millions of acre feet per year):

Sugar Beets	0.57
Tomatoes	0.58
Subtropical	0.78
Other Field	0.85
Almonds, Pistachios	0.88
Grain	1.00
Corn	1.14
Other Truck	1.18
Other Deciduous	1.47
Rice	1.50
Grapes	2.20
Cotton	3.50
Pasture	4.03
Alfalfa	4.70
TOTAL	22.38

b. Delta Agricultural Water Use. Approximately 520,000 acres in the Delta are used for agriculture, producing almost \$500 million in various crops; about 3% of the State's agricultural production. All irrigation for Delta agriculture is diverted directly from Delta channels.

Irrigation is closely associated with soil type: the West and Central Delta are mainly organic soils and the North and South Delta are largely mineral soils. Subirrigation, the practice of applying water from beneath the soils surface rather than from the surface, is the predominant method of irrigation in organic soil locations since they are generally well below sea level and over high groundwater levels. Subirrigation is not conducive to continuous leaching. The

organic soils are more sensitive to salinity concentrations in adjacent Delta channels. Conventional irrigation and leaching practices are used on mineral soils.

Irrigation water for the Delta agricultural lands is transported via 1,800 intakes along sloughs and channels (see Figure 4). Summer irrigation water use Deltawide can total 5,000 cubic feet per second.

2. Statewide Urban Uses.

About 20 million people, about two-thirds of the State, receives some of its drinking water from the Delta. Residential water use is about 54% of "urban" water use; the remainder is used for commercial, industrial, and governmental uses, including parks and golf courses. For residential use, the breakdown is:

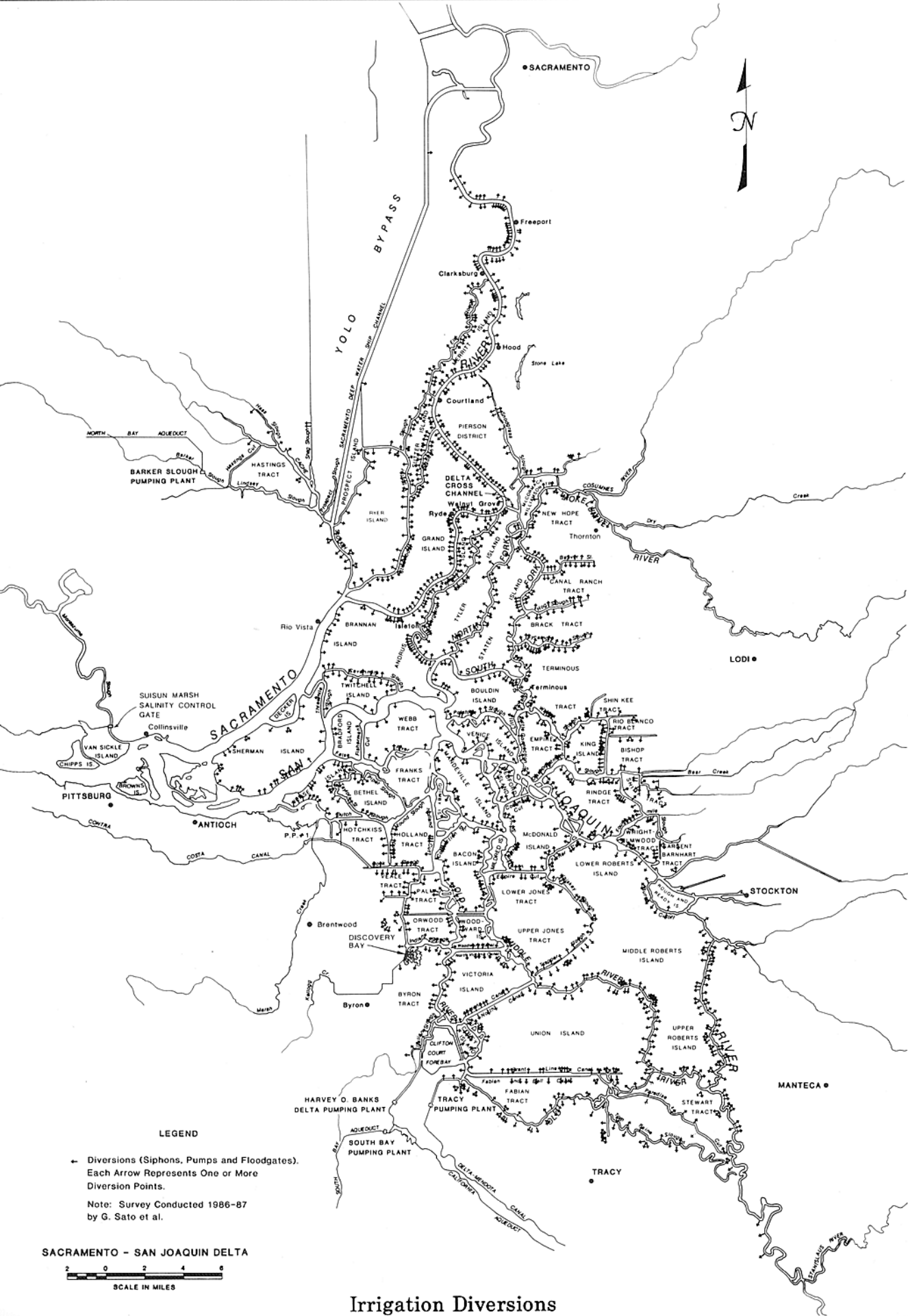
Toilet	13%
Bath/Shower	10%
Dishwashing	1%
Laundry	7%
Faucets	5%
Dishwashing	1%
Outdoor Use	18% (highly variable; can be up to 50%)

The State and local governments have been working with water suppliers to reduce water use per capita. Key areas for reducing household water use include low-flow toilets and showers, and low water-using landscaping. Some of these elements are already required under local or State codes.

3. Other Water Uses.

Other major water uses statewide include: wildlife refuges, which need about 500,000 acre feet a year; freshwater outflow from the Delta to meet salinity standards--the amount is currently under debate due to newly released directives from the Environmental Protection Agency; power plant cooling and oil recovery processes (less than 100,000 acre feet per year); wild and scenic rivers (average 17.8 million acre feet of water per year); and other natural uses, e.g. native vegetation and evapotranspiration (114 million acre feet per year).

In 1992, the Central Valley Project Improvement Act was passed by Congress. This law gives fish and wildlife protection equal footing with agricultural and urban water supplies as primary users of the CVP project, which delivers about 20% of the water used in the State. The law allocates some 800,000 acre feet per year to Central Valley fish and wildlife and requires that water be released from dams to flow through the Delta and Bay to the Pacific Ocean (5).



Chapter III: REGULATION OF WATER (6)

Regulation of water falls into two categories: water quality and use of water. The quality of water is regulated by the federal and State laws, and the regulation is carried out primarily by the State Water Resources Control Board (SWRCB) that sets statewide criteria, and the Regional Water Quality Control Boards (RWQCB) that carry out actual permit issuance and perform inspections and testing. The RWQCB issue permits under both federal and State law. Most of the Delta is under the jurisdiction of the Central Valley RWQCB: Winter Island, Browns Island, portions of the City of Antioch, and the Suisun Marsh area are within the jurisdiction of the San Francisco RWQCB. Use of State waters falls under jurisdiction of SWRCB which issues permits for use of surface waters; use of riparian and groundwater is less regulated.

The SWRCB sets statewide standards for water quality which are implemented at the regional level by the RWQCB. The SWRCB must adopt standards and a water quality control plan under the federal Clean Water Act. The California Enclosed Bays and Estuaries Plan (April 1991) contains three major sections: beneficial uses, water quality objectives, and an implementation plan. Generally, the SWRCB Plan seeks to protect aquatic life, and protect human health and beneficial uses as set out in the Basin Plan. The Plan includes Performance Goals for Agricultural Drainage; application of this program is under debate between the SWRCB and EPA.

The RWQCB has adopted a Basin Plan for the Central Valley and Delta. The Plan, last updated in 1990, describes beneficial uses of the waters; describes water quality objectives; outlines typical water quality concerns; and describes the Board's regulatory process. The Basin Plan is a more specific set of guidelines for this specific region.

1. Areas of Government Authority.

The federal government has acted to increase flows through the Delta to enhance aquatic habitat, set standards of water quality in the Delta, to set water quality standards that are carried out by the State, and to regulate marine sanitation devices.

State government has adopted a series of laws which promote water conservation, better irrigation techniques to conserve water supplies, water transfers, construction of off-stream water storage, protection of ground water quality, and protection of aquatic habitat (7).

Local government may also adopt regulations promoting water conservation in private and public buildings and in landscaped areas; promoting use of "gray water" (laundry, bath, and shower water); requiring use of reclaimed water for irrigation, particularly of public lands and extensive uses such as golf courses; monitoring of authorized wells and septic tanks; regulation of discharge of sewage from houseboats; and regulating the number and operation of pumpouts at permitted marinas.

2. Regulation of Water Quality.

Water quality is regulated by RWQCB which gives permits to dischargers (see Figure 5). Water quality in the Delta is of high importance because two-thirds of the State gets at least a portion of its drinking water from the Delta. The water quality standards for drinking water are generally more strict than those for other uses including agriculture. Water quality concerns in the Delta related to drinking water include:

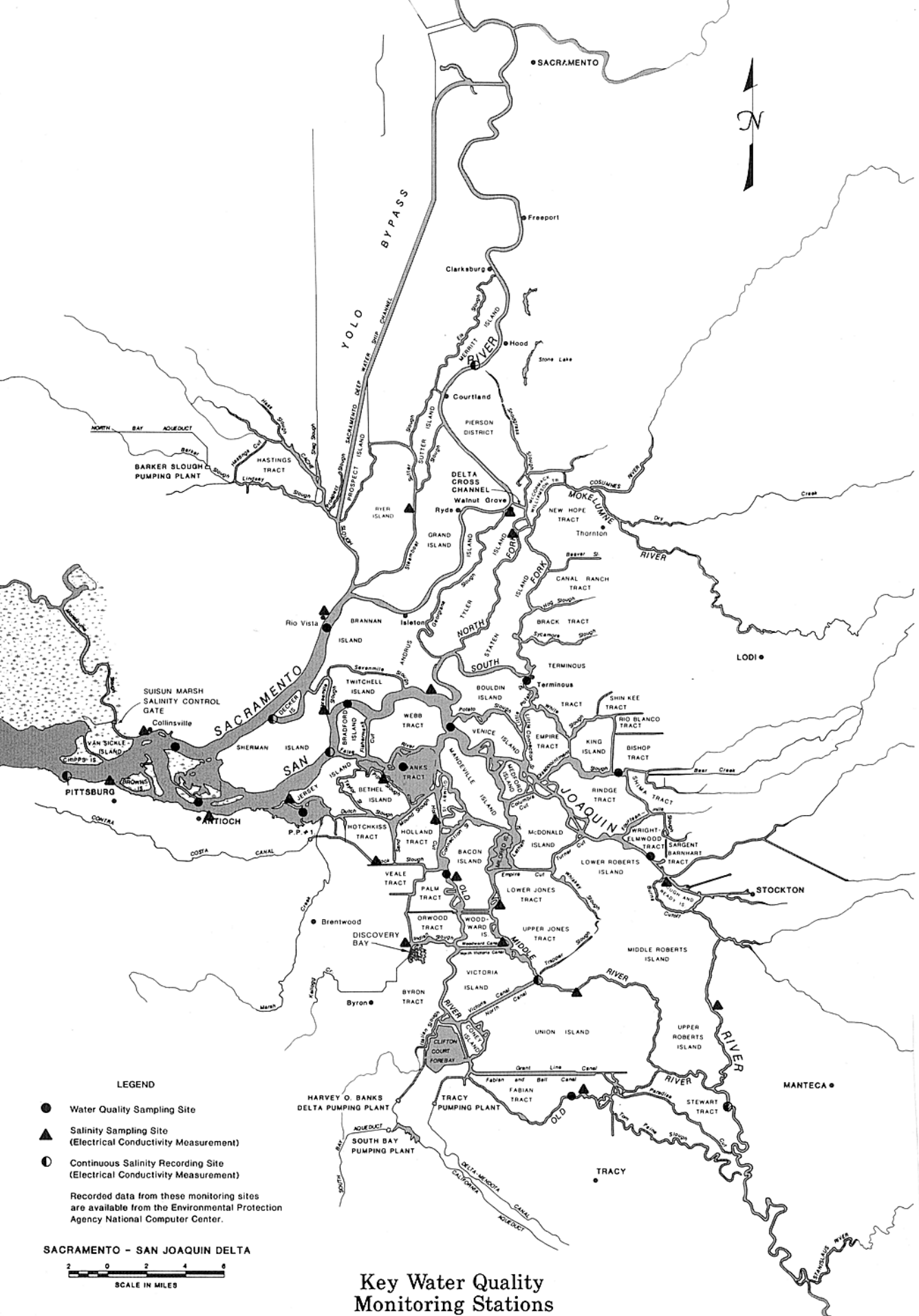
Possible salinity intrusion into the western Delta from San Francisco Bay.

Wastewater discharges sometimes contain disease organisms and chemical pollutants.

Agricultural drainage water may contain pesticide residues and other toxic agents.

Storm drainage water can contain traces of gasoline, oil, rubber, asbestos, lead, and pesticides.

Tests show Delta water supplies at times contain pesticides and industrial chemicals that may pose a threat to aquatic life, but that are well within safe drinking water guidelines (8). The primary concern over drinking water taken from the Delta relates to trihalomethanes (THM). If water containing peat soil residue is treated with chlorine to disinfect drinking water and bromides from sea water, then THM can be created. THM are suspected carcinogens. The Environmental Protection Agency (EPA) will be releasing new national drinking water standards in the future which will include new, tougher standards for THM. There are alternative treatment methods which do not result in creation of THM.



3. Regulation of Use of Water.

Regulation of the use of water including the amounts of water that can be taken out of the State's rivers, is regulated under federal and State law. Again, the SWRCB has statewide authority over requests to move water around the State; the DWR has primary responsibility for managing the SWP which redistributes waters of the State from areas of surplus to areas of need. The Bureau of Reclamation manages the CVP, a similar water distribution project that transfers water within California from areas of surplus to areas of need.

Generally, all water belongs to the State; rights for the use of the water can be obtained, but not the ownership of the water. Under riparian water rights, if you own land contiguous to a stream, you have a right to use water from the stream in that stream's watershed. If you do not have riparian rights, you must have a permit from the State Water Resources Control Board to use surface waters. If you obtain rights, but do not use them for three years, you lose those rights; riparian rights cannot be lost by non-use unless the stream is adjudicated. If you own land, you have a right to use the groundwater underlying that land. No use of State waters can be wasteful or unreasonable under the State Constitution.

Riparian users, including Delta farmers, use about 3 million acre feet per year, about half in the Sacramento Basin and Delta. Users of appropriated surface water use about 16 million acre feet per year.

Current studies (9) now project chronic water shortages by 2020 by as much as 4.2 million acre feet in wet years and twice that amount in drought years. Total demand could reach 69.4 million acre feet, up from 63.7 million acre feet in 1990. Much of the demand will come from projected population growth in areas out of the Delta, from 30 million in 1990 to 49 million in 2020. The draft California Water Plan suggests taking western San Joaquin Valley agricultural lands, that produce "selenium-laden runoff" out of production to balance supply and demand. The report suggests overall irrigated lands may fall from 9.2 million acres in 1990 to 8.8 million acres in 2020. Other possible solutions include conservation and recycling, construction of proposed reservoirs, and an undetermined strategy to move more water through the Delta (10).

Extraction of groundwater is regulated by local governments through approvals of well permits. Few local governments have complete information available about groundwater basins, levels of use, or quality of groundwater. The primary area of interest to local governments is protecting public health of residents who drink groundwater--including residents in much of the Delta. While the existing Delta communities have community water districts to provide water for personal consumption and for fire fighting, individual farm properties use groundwater. It is important to protect wells from sewage and chemicals from septic tanks and leach fields, also used on individual farm properties. In addition, concentrations of manure or fertilizer can result in elevated nitrates in groundwater (11).

- a. Beneficial Uses of State Waters. SWRCB law defines the "beneficial uses" of State waters as those critical to water quality management in California and are uses which must be protected from degradation. The beneficial uses defined by SWRCB are:

Municipal and Domestic Supply

Agricultural Supply: Irrigation and Stock Watering

Industrial Process and Service Supply

Groundwater Recharge

Freshwater Replenishment

Navigation

Hydroelectric Power Generation

Water-Contact and Non-water-Contact Recreation

Freshwater Habitat

Preservation of Rare and Endangered Species

Fish Migration/Fish Spawning

- b. Water Quality Objectives for Surface Water. The Porter-Cologne Water Quality Control Act requires that the RWQCB set water quality objectives to protect designated beneficial uses.

The Central Valley RWQCB limits the following substances that would create a nuisance or adversely affect a beneficial use: (1) Biostimulatory Substances; (2) Color; (3) Floating Material; (4) Oil and Grease (no visible film); (5) Sediment; (6) Settleable Material; (7) Suspended Material; (8) Tastes and Odors; (9) Toxicity; (10) Chemical Constituents; and (11) Radioactivity.

More specific criteria have been set for the following:

Bacteria. In waters designated for contact recreation, the fecal coliform concentration shall not exceed 200/100 ml.

Dissolved Oxygen. In the Delta, the dissolved oxygen concentration shall not be reduced below 7.0 mg/l in the Sacramento River and 5.0 mg/l in all other Delta waters.

pH. The pH shall not be depressed below 6.5 nor raised above 8.5.

Pesticides. Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses. Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.

Salinity. Set out in D-1485 adopted August 1978.

Temperature. Temperature shall not be increased more than five degrees above natural receiving water temperature.

Turbidity. The turbidity of Delta waters shall not exceed 50 nephelometric turbidity units (NTU) in the Central Delta and 150 NTU in other Delta waters (except during dredging).

- c. Water Quality Objectives for Groundwater. Separate criteria have been set for groundwater and the Department of Health Services requires that municipal water supply agencies that use ground water test their water supplies for an extensive range of chemicals known to have the capacity to pollute underground water supplies. DWR keeps a statewide database of groundwater monitoring. State criteria are:

Bacteria. For groundwater used for domestic or municipal supply, coliform organisms over any seven day period shall be less than 2.2/100 ml.

Chemical Constituents.

Radioactivity.

Tastes and Odors.

- d. Regional Board Prohibitions. The Basin Plan includes some specific prohibitions including:

No direct discharge of wastes into the Sacramento Ship Channel and Turning Basin

Discharges of wastes from new and existing leaching and percolation systems in the Courtland Sanitation District, Sacramento County (2/27/76)

Discharge of petroleum to the waters of the State

Vessel wastes: discharge of toilet wastes from the vessels of all houseboat rental businesses on the Delta

Pesticides. Generally, discharge of agricultural drainage with molinate, thiobencard, carbofuran, malathion and methyl parathion is prohibited unless the discharge is in compliance with an approved management plan. (1991)

4. Water Quality Concerns.

- a. Agriculture. Irrigated agriculture accounts for most water use. Both the San Joaquin and Sacramento Rivers carry substantial amounts of agricultural return water. During the summer, a large part of the flow of the San Joaquin River is made up of

drainage--partly excess irrigation runoff from fields and partly flow from underground tile drains. Agricultural drainage contains salts, nutrients, pesticides, trace elements, sediments, and other by-products. Salt management is critical because evaporation and crop transpiration remove water from soils which can result in an accumulation of salts in the root zone of the soils. Additional amounts of water are applied to leach the salts below the root zones. The leached salts can reach ground or surface water. Pesticides and nutrients are also ingredients of agricultural drainwater and have been found in ground and surface waters in many areas. Fish and aquatic wildlife deaths attributable to pesticide contamination of surface water have occurred periodically in the past. Much of the material in agricultural drainage flows into the Delta from the surrounding watershed.

There are some water quality concerns associated with disposal of waters used to clean equipment or work areas associated with application of pesticides, disposal of pesticide rinse waters, and formulation of pesticides and fertilizers. Use and handling of these materials is regulated.

Runoff from animal confinement facilities (stockyards, dairies, poultry ranches) can impair both surface and ground water beneficial uses. The greatest potential for water quality problems stems from the overloading of containment ponds during the rainy season and seepage into groundwater.

b. Municipalities and Industries. Municipal and industrial point source discharges to surface waters are controlled by the National Pollution Discharge Elimination System (NPDES) permits. The permits are required by the federal Clean Water Act, and issued by the respective RWQCB.

Runoff (non-point discharge) from urban and industrial areas contributes to water quality degradation. Urban storm water runoff contains pesticides, oil, grease, and heavy metals. These pollutants accumulate during the dry summer months and the first major autumn storm can flush a highly concentrated load to receiving waters. These are pollutants that come into the Delta via runoff from areas of the watershed.

Continued urban/suburban development in the Delta watershed will result in increased surface runoff into the Delta. This source--nonpoint source pollution--is the largest contributor to volume of pollutants entering State waters, particularly San Francisco Bay Waters (12).

c. On-Site Sewage Disposal. Improperly located, designed, constructed and/or maintained on-site wastewater treatment and disposal systems can result in ground and surface water degradation and public health hazards. The RWQCB adopted guidelines with criteria for proper installation of conventional systems, and has prohibited usage in certain areas. The RWQCB leaves control with local government. Local government addresses these issues in rural areas through parcel size and by site-by-site analysis of homesite parcels which provide both drinking water via wells, and sewage disposal via septic tank or leach fields.

Chapter IV: DELTA ISSUES

1. Salinity.

Salinity is the a critical water quality concern for agriculture, for industrial use, and for drinking water. Salt enters the Delta from two main sources: sea water intrusion and in certain parts of the Delta, agricultural drainage. Salinity levels vary greatly in the Delta. The West Delta experiences sea level intrusion and associated salinity; the Central Delta has the freshest water; and the South Delta salinity levels are affected by dissolved salts (dissolved minerals) from agricultural drainage conveyed by the San Joaquin River. Salinity is a key issue because the salinity of the applied water has a direct relationship to salt content in the soil solution, which in turn affects crop yields and leaching requirements.

D-1485, adopted by the SWRCB sets water quality standards to protect Delta uses from excessive salinity intrusion. Currently, the objective for salinity is 0.45 EC (electrical conductivity). DWR has proposed relaxing the salinity objectives to 0.7 EC during irrigation season and 1.0 EC the remainder of the year in the southern Delta. In addition, DWR and SWRCB sponsored a four year study of corn grown with irrigation water of up to 1.5 EC; the conclusion of the study was that corn could be grown and maintained using saltier water as long as controlled leaching was performed periodically to remove accumulated salts (13).

Salts in South Delta channels are exported to the San Joaquin Valley, where the salinity levels are concentrated after irrigation and then released back into the San Joaquin River and the Delta. State and federal agencies have prepared a plan for management of agricultural drainage in the San Joaquin Valley to break this cycle and are currently trying to implement the plan.

New EPA-generated draft water standards attempt to lessen the salinity of Delta waters through release of additional freshwater, particularly when fish are migrating. It appears the federal standards will be implemented in 1994. It is not yet determined who will lose access to water to accommodate additional freshwater discharges.

High salinity levels affect use for all types of municipal uses from personal consumption to irrigation, and use for industrial purposes. High salinity in drinking water can pose a health hazard requiring replacement of tap water by bottled water. Industrial uses may also be affected and can result in slow-downs of production or plant closures.

2. Agricultural Discharges.

The Basin Plan regulates point discharges and recently began a multi-year program for regulation of agricultural discharges which had not been regulated previously (see Figure 6). Materials such as selenium and boron are found in agricultural discharges (14) but are below established guidelines.

Another by-product of agriculture is pesticide residue. Concerns about pesticides have resulted in conditional prohibitions of discharge of the following pesticides: molinate, thiobencarb, carbofuran, malathion, and methyl parathion. However, research and testing show

that pesticides continue to be washed into the State's waterways during winter storms. In one instance, chemicals washed by rain from orchards upstream of the Delta were found at Martinez at levels that pose a risk to aquatic life.

3. Wetland Habitat.

Attempts to enhance habitat for Delta fauna will include re-creation of wetland habitats. The biggest change in Delta habitats has been the removal of water from the Delta lands, particularly in winter when historically, the bowl-shaped islands would fill with rainfall and seasonal flood waters. Only very limited areas of true wetlands, with marsh vegetation and water regimes, remain within the islands or on channel islands.

Recreation of habitat include creation of additional areas of tidal habitat, seasonally flooded habitat, and permanent wetlands within levees. Proposals to enhance habitat on islands requires use of riparian water for growth of plants for feeding and sheltering fauna.

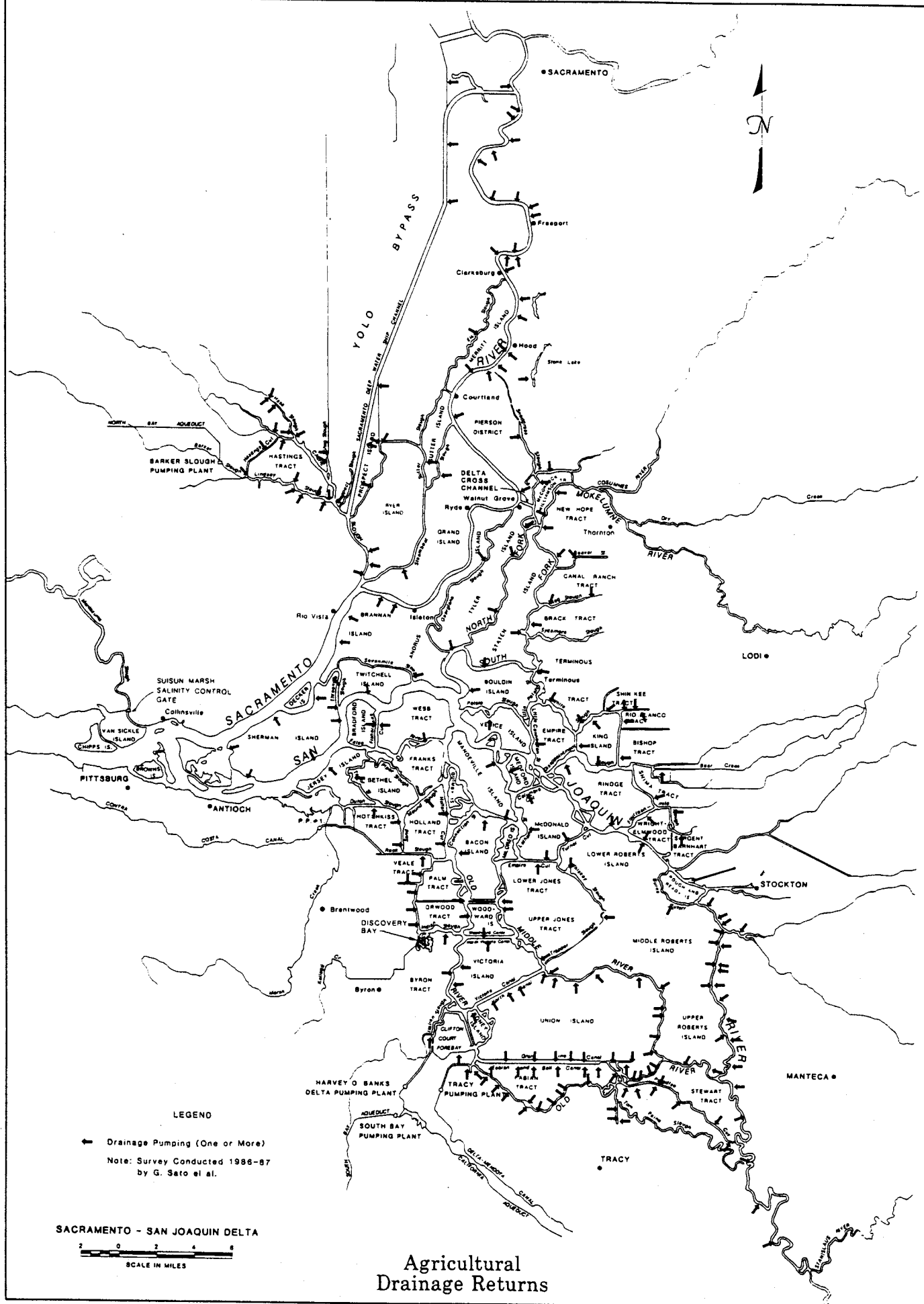
Several areas in the Delta are permanently flooded including Big Break, Franks Tract, and Mildred Island. The owners could not afford to repair levees around the islands. The flooding has resulted in creation of deep water aquatic habitat.

At several locations, Twitchell Island, Sherman Island, Palm Tract, Yolo Bypass and others, habitat enhancement will include managed wetlands. In these areas, the land is worked similarly to agricultural lands, but the crops are plants which will provide food and cover for resident and migratory species. In many areas, the primary goal is to provide seasonal waterfowl habitat. The lands will be drained in spring and summer, allowing the land to be disced, planted, and appropriate ditches added. The lands would be flooded to coincide with arrival of migratory waterfowl and other migratory birds. In the summer, the dry areas provide some habitat for small mammals which are hunted by hawks and other predatory resident birds. Water use in these areas will be limited; there is little evaporation in the winter months and there is excess flow in the waterways; the areas are dry in summer. Where lands are flooded year round, loss of water to evaporation exceeds agricultural use of water, on an acre by acre basis.

Habitat is also being created seasonally on many Delta islands through flooding of agriculture fields in the fall and winter months for example (Staten, Tyler, Venice). Farmers have traditionally flooded fields for leaching and for weed control. Current efforts are underway under the Central Valley Habitat Joint Venture to encourage flooding using best management practices to provide seasonal habitat for migratory waterfowl, shorebirds, and other birds. The amount of water added to the fields is small; the depth of water averages only about six inches (16). The time of flooding coincides with fall rains and releases from upstream dams for fall and winter fish migrations.

Some lands will be enhanced through creation of permanently flooded lands--in the Yolo Bypass, on a portion Palm Tract, and portions of Twitchell Island and Sherman Island. These ponded areas provide feeding and resting areas for resident birds, fish, mammals, and amphibians. Because the areas are flooded year-round, there will be evaporation in the summer months.

4. Mosquitoes. (17)



Mosquitoes are native insects to the Delta area. The draining of the Delta wetlands has eliminated much of the historic mosquito habitat. Re-creation of wetland areas and seasonal flooding of agricultural lands can provide habitat for mosquito reproduction, particularly in areas of standing water. Control of mosquitoes is carried out by four vector control districts (VCD): Contra Costa, Solano-Yolo, Sacramento, and San Joaquin. These are independent special districts with the ability to tax property owners to pay for their activities.

Five mosquito species are found in the Delta; two prefer flood water and three prefer standing water. Only two of the five mosquitoes carry encephalitis. The flood water type of mosquitoes grow between May and November. The standing water breeds appear between March and October; one from November to April. Eggs are laid on water or moist soil; however, all mosquitoes need water to develop from eggs to adults, in some species in as little as three to five days. All mosquito larvae need food, are air breathers, and need to be protected from currents and waves. Female adult mosquitoes can fly three to five miles to blood meals; humans are a very small percentage of blood meals, other hosts include rabbits, cattle, birds, horses, dogs, deer, and sheep.

The biggest health problem associated with mosquitoes is the ability of some species to carry and spread the encephalitis virus, commonly called sleeping sickness. There is no known treatment of the disease which attacks the brain leading to lethargy, coma, or even death. The disease is carried by birds and passed to mosquitoes upon feeding and after incubation is passed on to rabbits, humans or horses. It seems the virus is reintroduced each year, perhaps by migrant birds that winter in tropical areas. Flocks of chickens are kept to determine if the disease is being spread by mosquitoes.

The disease can be nonapparent, acute or fatal. The majority of cases are mild. Less than one percent of the individuals infected with the western equine encephalitis become ill and of these only a few develop acute symptoms or die from the disease. Children under 10 are more likely to become ill than members of other age groups. Twenty to 30% percent of cases occur in patients under one year of age.

Since 1945, 736 cases of western equine encephalitis have been diagnosed; 375 in a 1952 epidemic. Almost 90% of the cases occurred in the 1950's and 1960's. Since then human cases have been a rarity in California. Kern, Fresno, and San Joaquin Counties account for over half the reported cases in the State; San Joaquin County was 20% of that amount. The disease is primarily a rural disease associated with agricultural sources such as rice fields and standing field water, with 80% of cases reported in the months of July and August. In 1993, the California Department of Health Services reported one case of the St. Louis strain of encephalitis in a San Bernadino man. He recovered after an eight day hospital stay with no lasting effects (18).

VCDs seek to control mosquitoes by eliminating potential habitat, including areas of standing water, and by introducing predators, such as mosquito fish grown in special fish farms. When these methods fail, the Districts apply chemicals or biological agents.

In San Joaquin County, July 1992 to June 1993, figures show a range in the number of mosquitoes captured in the Delta area for the entire year. Less than 2,000 mosquitoes were caught at Holt; Thornton; Cal Pack Road, Stockton; Howard Road, Stockton; and Rindge Tract. At Staten Island, which is noted for winter flooding for migratory waterfowl, 3,071 mosquitoes were captured. Larger numbers were found at Bouldin Island (32,744) and Mandeville Island (47, 234). For contrast, mosquitoes captured in areas out of the Delta were: Tracy: 12; Howland Road, Lathrop: 101; and South Hammer Lane, Lodi: 553. The months of heaviest mosquito production are August, September, October, and November. Additional increases in numbers can occur in Spring, April, May and June.

5. Recreation.

The Delta is a valued, statewide resource for water-oriented recreation. Much of that recreation is water-contact recreation including water-skiing and jet ski riding. To protect public health, the RWQCB sets standards for water quality where water contact recreation exists. For waters designated for contact recreation, the RWQCB has set standards for fecal coliform bacteria concentration (not less than five samples for any 30 day period shall exceed a geometric mean of 200/100 ml, nor shall more than 10% of the total number of samples taken during any 30 day period exceed 400/100 ml).

Sources of fecal bacteria may include faulty septic tank or sewage treatment facilities, overflows of animal yard holding ponds, releases from boats, urban runoff, and others.

There is no on-going monitoring program to ensure that water-contact recreation standards are being met in the Delta. Sloughs, especially closed end sloughs with limited flushing area are more vulnerable to localized pollution.

Additional impacts to water quality are associated with release of bilge water and oily waste from recreational vessels.

6. Non-Point Pollutants. (19)

A number of pollutants are carried into Delta waters from areas upstream and downstream. Delta waters currently meet existing drinking water standards but future activity in the watershed could affect water quality levels. New drinking water standards may be adopted by the EPA.

a. Arsenic. Arsenic is toxic and carcinogenic, and occurs naturally in many areas. The current standard for drinking water is 0.05 milligrams per liter, but may be lowered by EPA soon. Typical arsenic concentrations in the Delta are: 0.002 lower Sacramento River; 0.003 lower San Joaquin River, and 0.003 southern Delta.

b. Bromides. Bromide is a salt ion present in sea water which may be present in waters exported from the Delta and is circulated from agricultural runoff from San Joaquin Valley farms. Bromide concentrations are higher in the Delta than in tributary streams. At Greene's Landing on the Sacramento River, the level is 0.03 milligrams per liter; at the Tracy pumping facility, the level is 0.35 milligrams per liter.

c. Upstream Mine Drainage. In the Delta watershed, old mines and mine debris discharge drainage which is high in metals such as copper and cadmium. Collectively, these comprise the largest source of toxic metals to the Delta. The metals do not present a significant threat to municipal users of Delta waters.

d. Pathogens. Microorganisms in water supplies fall into the categories of viruses, bacteria, and protozoa. Recent DWR studies (April 1992-April 1993) show the Delta waters are 6 times lower in Giardia, and Cryptosporidium than surface waters studied in nationwide surveys. The highest levels of pathogens were found at Greene's Landing, ten miles downstream of the City of Sacramento sewage treatment plant outfall. Possible sources of the pathogens include effluent from upstream sewage treatment plants, release of sewage from boats, upstream recreational activity, and/or nonpoint fecal discharge (20).

e. Selenium. The federal drinking water standard for selenium is 0.05 milligrams per liter and concentrations of selenium in the Delta are typically at or below 0.001 milligrams per liter, with the exception of the San Joaquin River as it enters the Delta. In the San Joaquin watershed, natural selenium deposits contribute to the agricultural drainage containing selenium. In the lower San Joaquin River, levels are typically 0.002 to 0.003 milligrams per liter, but may be as high as 0.005 milligrams per liter during winter months.

Adopted Findings

Findings:

- F-1. Water flows from the Central Valley watershed into the Delta. The Delta's natural and constructed waterways transport water towards lower elevation areas and San Francisco Bay, and to the State and federal project pumps.
- F-2. About 83% of the State's developed water is used for agricultural irrigation. Developed water means water stored and managed for urban, agricultural, or environmental uses.
- F-3. Most Delta farms use water taken directly from Delta sloughs and rivers under riparian water rights through unscreened diversions.
- F-4. Urban water users use about 17% of the State's developed water; residential water use is about half that amount.
- F-5. Other water uses which use approximately 132 million acre feet per year include: wildlife habitat, salinity control, wild and scenic rivers, and other natural uses.
- F-6. The Central Valley Regional Water Quality Control Board has designated the following beneficial uses in the Delta:
 - Municipal and Domestic Supply
 - Agricultural Supply: Irrigation and Stock Watering
 - Industrial Process and Service Supply
 - Groundwater Recharge
 - Freshwater Replenishment
 - Navigation
 - Hydroelectric Power Generation
 - Water-Contact and Nonwater-Contact Recreation
 - Freshwater Habitat
 - Preservation of Rare and Endangered Species
 - Fish Migration/Fish Spawning
- F-7. Water quality is regulated by the State Water Resources Control Board and both the Central Valley Regional Water Quality Control Board (Central and Eastern Delta) and the San Francisco Regional Water Quality Control Board (Western Delta) under both State and federal laws.
- F-8. Use of water is regulated by the State Water Resources Control Board, and by the federal government as it affects critical environmental issues.
- F-9. Water in the Delta generally meets current standards for beneficial uses, including drinking water standards once the water is treated.

- F-10. Water quality issues include: ocean salinity intrusion; materials carried in agricultural return waters; runoff from urban areas in the Delta watershed including discharge of treated municipal wastewater; formation of trihalomethane precursors and other disinfection by-products in drinking water resulting from chemicals added during water treatment processes; possible local problems associated with on-site sewage disposal; and on-land disposal of biosolids (sledge) and treated wastewater.
- F-11. Salinity is a key Delta water quality issue which affects land use, and which is under regulation of the State and federal agencies.
- F-12. The impacts of non-point source discharges including agricultural discharges, both within and upstream of the Delta, are currently being studied and subjected to increasing regulation.
- F-13. Water is needed to enhance seasonal and year-round wildlife habitat in the Delta such as flooding agricultural fields in fall and winter. Seasonal flooding is of particular value to migratory waterfowl.
- F-14. Flooding in the Delta, if not properly managed can create habitat for mosquitoes, a concern where wetlands and population centers are near to each other.
- F-15. Water-contact recreation is popular in the Delta and requires appropriate water quality.
- F-16. Water regulators, water producers, and water consumers all hold interests and responsibilities for various aspects of the State's waters. The responsibilities of various agencies are set out in State and federal laws and regulations.
- F-17. Transport of State and federal project water through the Delta does result in levee erosion and reverse flows and may detrimentally affect some fish species.
- F-18. Recreational boating activities may degrade water quality by increasing turbidity, release of oily wastes, particularly from outboard motors, anti-fouling paints, and release of untreated sewage and other wastes.
- F-19. Commercial shipping vessel activities may degrade water quality by increasing turbidity, releasing bilge water, and discharging other solid and liquid wastes.
- F-20. The State has contracts, which are enforceable in court, with a number of entities in the Delta, including the North and South Delta Water Agencies and the East Contra Costa Irrigation district, that deal with specified needs in the Agencies' boundaries for water for agricultural use.
- F-21. In 1992, Governor Pete Wilson established a comprehensive state water policy. In 1994, the Governor and the Secretary of the Interior, and others, signed the CALFED accord setting water policy for the next three years and outlining a new process for a long-term resolution of California's water issues.

Adopted Policies:

- P-1. Salinity levels in Delta waters shall ensure full agricultural use of Delta agricultural lands, provide habitat for aquatic life, and meet requirements for drinking water and industrial uses.**
- P-2. Design, construction, and management of any flooding program to provide seasonal wildlife habitat on agricultural lands shall incorporate “best management practices” to minimize mosquito breeding opportunities and should be coordinated with the local vector control district. Each of the four vector control districts in the Delta provides specific wetland/mosquito management criteria to landowners within their district..**
- P-3. Water agencies at local, state, and federal levels should work together to ensure that adequate Delta water quality standards are set and met and that beneficial uses of State waters are protected consistent with the CALFED agreement.**

Adopted Recommendations

- R-1. The Delta waterways should continue to serve as a primary transportation system moving water to the State's natural and developed water systems.*
- R-2. Delta water rights should be respected and protected.*
- R-3. Programs to enhance the natural values of the State's aquatic habitats and water quality will benefit the Delta and should be supported.*
- R-4. Programs to regulate agricultural drainage in the Delta should be accompanied with education programs, be implemented over time, and should, where needed, provide financial assistance such as grants and interest-free loans to ensure compliance. Any regulation of Delta agricultural discharges must recognize that a) dischargers must be permitted to discharge back to the channels any dissolved solid loads that are derived from the channels in irrigation diversions and seepage inflows, and b) any net addition of dissolved carbon compounds must be compared to the addition of such compounds that would occur with any other land use option that would provide equal protection of the land and channel configuration and would consume no more water.*
- R-5. Water for flooding to provide seasonal and year-round wildlife habitat should be provided as part of State and federal programs to provide water for wildlife habitat.*
- R-6. Water quality monitoring programs should measure Delta waters to ensure they meet water-contact recreation and other water quality standards.*
- R-7. State and federal water projects are beneficiaries of the Delta waterways and levees; the projects should fund that portion of levee erosion caused by water transport and should continue programs that fund protection of Delta levees.*
- R-8. Water quality at Delta drinking water intakes should be maintained or enhanced.*

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